

REMARKS

This is in response to a non-final Office Action dated February 27, 2007. Claims 66, 67, and 88-89 (which were withdrawn from consideration) and 91-106 were pending in the patent application at the time that the Office Action was mailed. By this Amendment, claims 66, 67 and 90 have been canceled, and independent claims 91 and 101 have been amended. Along with this Amendment, Applicants additionally submit an inventor's declaration, and a written consent statement of the assignee, PS/EMC West LLC.

In the Office Action, the specification was objected to under 37 C.F.R. §1.71(a) as being non-enabling for allegedly failing to make clear the distinction between an "analog condition" and a "firing condition." Claims 66, 67 and 90-100 were rejected under 35 U.S.C. § 112, first paragraph. Claims 66, 67, and 90 were additionally rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over U.S. Patent No. 5,460,093 to Prinz ("Prinz") in view of U.S. Patent No. 6,584,907 to Boucher ("Boucher"). Claims 66 and 67 were further rejected under 35 U.S.C. § 103(a) as being allegedly obvious over Figure 5 in Boucher in view of "the embodiment of Fig. 1A" and further in view of U.S. Patent No. 4,860,653 issued to Abouv ("Abouv"). Claims 90 and 101-103 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv and further in view of U.S. Patent No. 5,894,103 to Shann ("Shann"). Claims 91, 92, 94 and 95 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv and further in view of Applicants' alleged admission.

Additionally, claims 93 and 97 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher, Abouv, Applicants' alleged admission, and further in view of Shann. Claim 96 was rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher, Abouv, Applicants' alleged admission, Shann, and further in view of U.S. Patent No. 4,674,047 to Tyler ("Tyler"). Claims 98-100 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher, Abouv, Applicants'

alleged admission, and Tyler. Lastly, claims 104-106 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher, Abouv, Applicants' alleged admission, Shann, and further in view of Tyler.

Substance of Interview

A telephonic interview with the Examiner, inventor Steven D. Nelson, and the Applicants' representative was held on May 22, 2007. Applicants thank Examiner Chambers for his time and consideration of the discussion. During the interview, a proposed amendment to independent claim 91 was discussed. Specifically, Applicants' representative provided support in the specification for the claim and explained why the claim overcomes the prior art rejections.

Mr. Nelson also explained significant aspects of the claimed, inventive system. As he described, in order for the claimed networked pyrotechnic device to fire, its logic device must detect a firing command and its bus interface must sense that an analog condition of the network has been altered to correspond to that firing command. Mr. Nelson further added that the inventive system is designed such that an armed pyrotechnic device disarms upon detecting a digital disarming command transmitted across the network having a unique identifier for that pyrotechnic device. Mr. Nelson explained that, as a direct result of these features, the applicants' product has been recognized in the industry as a breakthrough improvement in safety and overall performance for pyrotechnic devices, and has achieved commercial success precisely because of the critical importance associated with this improvement in safety and overall performance.

During the interview, Examiner Chambers agreed that the proposed amended claim appears to be distinct from Boucher. Additionally, Examiner Chambers agreed that changing the claimed phrase "the bus interface senses that the analog condition of the network has been modified to the firing condition" to instead recite that "the bus interface senses that the analog condition of the network corresponds to the received firing

command" clarifies the claim and tracks the disclosure on page 20, lines 3-5 and 10-11 of the specification.

Response to Office Action

In this response, by these Remarks and the declaration of inventor Steven D. Nelson, Applicants intend to reiterate the points discussed during the interview and address the various objections and rejections in the pending Office Action, in light of the amendments to independent claims 91 and 101.

1. Correction of Inventorship

The Office Action declines to acknowledge the Applicants' request for inventorship filed on April 19, 2001 because 37 C.F.R. § 1.48 requires written consent of an assignee, and "[a]t this time, it is unclear whether Special Devices is a legitimate assignee of record."

On April 19, 2001, when the Applicants' request to correct inventorship was filed, Special Devices, Inc. was the assignee of record. The April 19, 2001 filing included a copy of the assignments of the named inventors, Steven D. Nelson and Michael N. Diamond, to Special Devices, Inc., a new declaration signed by Steven D. Nelson, Michael N. Diamond, and John J. Walsh, and written consent of the assignee at the time, Special Devices, Inc.

On July 18, 2001, Special Devices, Inc. assigned all rights, title and interest in and to the patent application to PS/EMC West, LLC. On June 9, 2005, John J. Walsh assigned his interest in the patent application to Special Devices, Inc., and its successors and assigns, which is PS/EMC West LLC, via the July 18, 2001 assignment agreement.

With today's filing in response to the Office Action mailed February 27, 2007, Applicants include written consent of the assignee, PS/EMC West LLC, to correct inventorship by adding John J. Walsh as an inventor. With that consent, Applicants respectfully request reconsideration of Applicants' Request filed April 19, 2001.

2. Objection to the Specification

The Office Action additionally objects to the specification under 37 CFR § 1.71(a) as failing to clearly explain the distinction between the "analog condition" and the "firing condition." The Office Action acknowledges that the "analog condition" is defined in the specification, but asserts that the specification "equates the analog condition with the firing command" and does not describe the firing condition.

As discussed during the interview, the objection in the Office Action is believed to have been overcome by amending independent claim 91 to no longer recite the term "firing condition." As on page 20 lines 10-11 of the specification, claim 91 now recites that "the bus interface senses that the analog condition of the network corresponds to the received firing command." The following provides additional supporting context in the specification for this claimed phrase.

a. Analog Condition

The "analog condition" of the network refers to a characteristic of the electrical power transmitted across the cable network, or bus. (See page 19, lines 5-7.) The use of the word "analog" distinguishes this condition from digital signaling transmitted on the bus to communicate control signals, such as the firing signal.

As the Office Action acknowledges, page 19 of the specification discloses that the voltage, modulation depth, or frequency of the electrical power signal that is being transmitted on the cable network 204 are characteristics of the signal that can be "sensed" by the bus interface 312 in a pyrotechnic device. (Page 19, lines 5-11.) Any of these characteristics can be considered an "analog condition" of the power signal.

The specification additionally provides that the bus controller 206 or other devices electrically connected to the pyrotechnic system 200 may be used to alter the analog condition of the cable network 204. (Page 19, lines 2-4.) Referring to lines 5-11, "altering"

the condition can mean changing the voltage, modulation depth, or frequency of the transmitted electrical power signal. The bus interface (or some other component of the pyrotechnic device) can sense the analog condition, and thus, sense the change.

b. Firing Command

The specification additionally provides that "for an armed pyrotechnic device to fire, it must receive a digital firing command and sense proper analog conditions on the cable network 204." (Page 18, lines 18-19.) The specification further describes that "[i]n a preferred embodiment, the firing signal consists of a fire command and an address frame. The address frame ... allows a fire command to be transmitted to one or more specific armed pyrotechnic devices 202." (Page 19, lines 18-21.) The specification also discloses that the firing signal is issued by the bus controller 206. (Page 19, lines 12-13.)

c. Altering the Analog Condition to a Firing Condition, Corresponding to the Firing Command

As described in the specification, safety is enhanced by the claimed pyrotechnic device 202 because it is required "to sense both a digital firing signal and a corresponding analog bus condition before firing the initiator 304." (Page 20, lines 5-7.) The specification further explains that:

When a particular logic device 300 receives the firing signal, it communicates with the bus interface 312 to determine whether the bus interface 312 senses the analog condition corresponding to the firing command.

(Page 20, lines 2-5.) If the bus interface senses that the analog condition has not been altered, then the pyrotechnic device will not fire the initiator, even if the logic device detects a firing signal. As the specification provides, "if the logic device 300 erroneously reads a digital firing signal at a time when the pyrotechnic device 202 is not armed, it cannot fire

the initiator 304, because the analog bus condition will not correspond to the condition required for firing." (Page 20, lines 7-9.)

The specification also provides that, "at or shortly before transmitting a firing signal to one or more armed pyrotechnic devices 202, the analog condition of the bus is altered to a firing condition." Taking the specification as a whole, one of ordinary skill in the art at the time of the invention would have understood this to disclose that the analog condition of the bus is altered *so as to place the bus into* a condition required for firing. (See the Declaration of Steven D. Nelson for additional discussion regarding this.) Nonetheless, to remove any possible ambiguity, the term "firing condition" has been deleted from the pending claims.

3. Claim Rejections under 35 U.S.C. 112, 1st paragraph

The Office Action additionally rejects claims 66, 67, and 90-100 under 35 U.S.C. 112, 1st paragraph as failing to comply with the enablement requirement. Referring to the objection to the specification, the Office Action determines that "the features of the firing condition are not disclosed at all," and that the specification does not disclose "what is the condition of the bus when it is in the analog condition" and "when it is in the firing condition."

As a result of this Amendment, claims 66 and 67 have been canceled, and claim 91 has been amended to delete the recitation of "firing condition." Accordingly, it is respectfully submitted that Applicants have overcome this rejection by the Amendment.

For the sake of clarity, Applicants reiterate the discussion above, as well as the discussion in the interview concerning the meaning of the "analog condition" and the "firing condition." As defined by the specification, "the analog condition of the cable network 204 is preferably a characteristic of the electrical power transmitted across that cable network 204," such as the voltage level, modulation depth or frequency. (Page 19, lines 5-9.) There is always an analog condition. When it is altered, there is still an analog condition,

but, for example, the characteristic of the electrical power across the network is then transmitted at an altered voltage level, modulation depth, or frequency. When the logic device determines that the characteristic of the electrical power has been altered to correspond with the firing command, the logic device then operates the initiator to fire the pyrotechnic device. (Page 20, lines 10-11.)

One of ordinary skill in the art at the time of the invention would have found the disclosure enabling to make and/or use the invention. Any network technician would have been capable of altering the voltage, modulation depth, or frequency of a network bus. As described in the specification, the claimed invention associates the altered voltage, modulation depth, or frequency value with a firing command, and programs the logic device so that the pyrotechnic device can only fire if the logic device determines that (i) a firing command is received and (ii) the voltage, modulation depth, or frequency of the bus has been altered so as to correspond with the firing command. (Please see the Declaration of Steven D. Nelson for additional supporting discussion.)

4. Prior Art Rejections

During the interview, the Applicants' representative, Mr. Nelson, and the Examiner discussed at length the distinctions between the cited references and the proposed amended claim 91. A more complete discussion is provided below.

Claim 91

The Office Action rejects claim 91 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission.

Claim 91 recites a networked electronic ordnance system comprising a bus controller and a plurality of pyrotechnic devices connected to the bus controller through a network. The pyrotechnic devices include a bus interface for sensing the analog condition

of the network, and a logic device that releases stored activation energy into an initiator upon detecting that (1) a digital firing command is received that includes its unique identifier, and (2) determining that the bus interface senses that the analog condition of the network corresponds to the received firing command.

Boucher is directed to an ordnance firing system in which communication signals are carried at a first voltage and arming signals are provided at a second, higher voltage. (Boucher, Abstract.) Boucher describes that the communication signals are carried at a lower voltage that is "preferably lower than the no-fire threshold of the initiators" so that "test and programming signals that are not intended themselves to arm and/or initiate the initiators are carried out at a level that is insufficient to arm and/or initiate the initiators even if the communication signals are somehow misinterpreted." (Boucher, column 11, lines 1-6.) Boucher further describes that "the energy for arming the initiators may be provided at a higher level than the communication signal level" – 28 volts instead of 7 volts. (Boucher, column 11, lines 7-9.)

Thus, Boucher alters the analog condition of the network so that communication signals are communicated at a low voltage that is insufficient to fire the initiators, and arming signals are communicated at a higher voltage analog condition that is sufficient to arm or initiate the initiators.

Significantly, Boucher does not include a bus interface that senses the analog condition of the network. Furthermore, while Boucher's pyrotechnic devices each includes an addressable logic device to detect digital, addressable commands, Boucher's logic devices do not "determine that the bus interface senses that the analog condition of the network corresponds to the received firing command," as recited in claim 91.

Accordingly, Boucher fails to teach the important aspect recited in claim 91 that enhances safety. (Please also see the Declaration of Steven D. Nelson, submitted herewith.) While Boucher discloses transmitting an arming signal and a firing signal, the

reference fails to disclose a logic device that will only fire if it both (1) detects the digital firing command and (2) determines that the bus interface senses that the analog condition of the network corresponds to the received firing command.

Figure 3 of Boucher illustrates the failings in the prior art. As can be seen, multiple ARM commands are received, each of which incrementally raises the capacitor firing voltage as a partial charge, before it drains out through a bleed resistor. To fire, enough ARM commands have to be received so that the capacitor reaches a sufficiently high voltage. Boucher describes that:

Once armed, i.e., once firing capacitor 26 is charged sufficiently to initiate the initiation element in the initiator, the periodic arm commands must continue in order to maintain the sufficient charge in capacitor 26.

(Boucher, column 14, line 53 – 57.) Thus, in Boucher, the pyrotechnic device fires when a firing signal is detected and enough ARM signals are transmitted to charge the capacitor to a sufficient level to initiate the initiation element. In other words, when the firing signal is received, the pyrotechnic device will attempt to initiate the initiation element, but if the capacitor has not been charged sufficiently, it will not work.

In contrast, claim 91 recites a safety mechanism that is far more secure. The claimed pyrotechnic device does not alter the analog condition of the network to arm the device, but rather, it alters the analog condition of the network as a third condition, which is sensed by the bus interface, and then used by the logic device to determine whether the analog condition of the bus corresponds to the received firing command.

The rejection of claim 91 in the Office Action combines Boucher with Abou and an alleged admission by the Applicants. As stated in the Office Action, Abou discloses detonator assemblies having a microcomputer with a memory that stores an arm code and an actuate code. The Office Action concludes that "at the time of the invention, one having

ordinary skill in the art would have found it obvious to provide ordnance system of Boucher with the digital signal sending and receiving capabilities of Abouv."

Like Boucher, Abouv also does not disclose a bus interface for sensing an analog condition of a bus. Furthermore, like Boucher, Abouv discloses a logic device for detecting digital commands, but the reference does not teach that the logic device can determine whether the bus interface senses that the analog condition of the network corresponds to the received firing command. Thus, Abouv does not add any relevant teaching beyond Boucher.

Lastly, the Office Action combines an alleged admission by Applicants. Particularly, the Office Action states that "Applicant's specification (pg. 7, ll. 10-14) describes a bus interface and provides that such an interface is well known to those skilled in the art." By this statement, Applicants were merely stating that bus interfaces were well-known to be "an electronic component that preferably accepts signals from the cable network 204 before those signals are passed further into the pyrotechnic device 202." By this statement, Applicants were not admitting that it was known to use a bus interface to sense the analog condition of the network and then use the logic device to determine that the bus interface senses the analog condition corresponding to the firing command, as recited in claim 91 and disclosed on page 20, lines 10-11 of the application.

Claim 93

The Office Action rejects dependent claim 92 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission, and further in view of Shann.

Dependent claim 93 further provides that the at least one pyrotechnic device discharges the stored activation energy when a digital disarming command is received that includes the unique identifier of its logic device.

As the Office Action acknowledges, none of the combined references discloses a digital disarm command. Shann discloses that an "abort" signal can be applied in the event that a fault occurs prior to transmitting a fire signal, and that the abort signal is transmitted to each of the circuits to cause the devices to effect a rapid discharge of the capacitors to prevent the detonators from detonating. The "abort signal" in Shann does not include the unique identifier of its logic device, as recited in claim 93. Accordingly, in Shann, the pyrotechnic devices cannot be uniquely identified to selectively disarm.

Claims 94 and 95

The Office Action rejects dependent claims 94 and 95 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission.

It is respectfully submitted that it would not be obvious to combine Abouv with Boucher, considering that Abouv provides no discussion of a missile or an aircraft. Physical limitations associated with electronics incorporated into a missile or aircraft are quite distinct from those to be used in a console for a mining operation. One skilled in the art would not have looked to Abouv for solving the failings of Boucher.

Claim 96

The Office Action rejects dependent claim 96 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission and Shann and further in view of Tyler.

Claim 96 further recites that, after a disarming command has been acted upon in the pyrotechnic device, the pyrotechnic device responds to the bus controller by transmitting its disarmed status over the network.

As the Office Action acknowledges, neither Boucher, Abouv, Shann or the alleged Applicants' admission discloses transmitting a disarmed status. The Office Action cites Tyler for disclosing a computer in which status checks are performed. However, the claim recites that "after a disarming command has been acted upon, the pyrotechnic device responds to the bus controller by transmitting its disarmed status". The mere disclosure in Tyler of a computer that can transmit the status of a network is insufficient. There is no teaching in Tyler or any other applied reference, taken alone or in combination, about "responding" to the bus controller by transmitting the disarmed status for a device after the disarming command has been acted upon.

Claim 97

The Office Action rejects dependent claim 97 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission in further view of Shann.

Claim 97 recites that the bus controller generates the digital arming command. The rejection in the Office Action is directed to an abort command, not a digital arming command as recited in the claim.

Claim 98

The Office Action rejects dependent claim 98 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission and Shann and further in view of Tyler.

Claim 98 further recites that, after an arming command has been acted upon in the pyrotechnic device, the pyrotechnic device responds to the bus controller by transmitting its armed status over the network.

The Office Action cites Tyler for disclosing a computer in which status checks are performed. However, the claim recites that "after an arming command has been acted upon, the pyrotechnic device responds to the bus controller by transmitting its armed status." The mere disclosure in Tyler of a computer that can transmit the status of a network is insufficient. There is no teaching in Tyler or any other applied reference, taken alone or in combination, about "responding" to the bus controller by transmitting the armed status for a device after the arming command has been acted upon.

Claim 99

The Office Action rejects dependent claim 99 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission and Shann and further in view of Tyler.

Claim 99 further recites that the bus controller periodically queries pyrotechnic devices at regular intervals to confirm that firing capability in the device remains intact.

The Office Action cites Tyler for disclosing a computer in which status checks are performed. However, the claim recites that "the bus controller periodically queries pyrotechnic devices at regular intervals." The mere disclosure in Tyler of a computer that can transmit the status of a network is insufficient. The Office Action provides no teaching in Tyler or any other applied reference, taken alone or in combination, about "periodic queries at regular intervals" or any querying about whether firing capability remains intact.

Claim 100

The Office Action rejects dependent claim 100 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Applicants' alleged admission and Shann and further in view of Tyler.

Claim 100 further recites that the bus controller determines network status by transmitting a network signal to one or more pyrotechnic devices and then sensing whether the signal is echoed back in response.

The Office Action cites Tyler for disclosing a computer in which status checks are performed. However, the claim recites that "the bus controller senses whether a network signal is echoed back." The mere disclosure in Tyler of a computer that can transmit the status of a network is insufficient. The Office Action provides no teaching in Tyler or any other applied reference, taken alone or in combination, about "echoing back" a network signal as an efficient mechanism for determining status.

Claim 101

The Office Action rejects independent claim 101 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Shann.

Independent claim 101 is directed to a networked electronic ordnance system having a logic device having a unique identifier that stores activation energy upon receiving a digital arming command that includes its unique identifier, and (A) releases the stored activation energy into its initiator when a digital firing command is received that includes its unique identifier, and (B) discharges the stored activation energy when a digital disarming command is received that includes its unique identifier.

As the Office Action acknowledges, none of the combined references discloses a digital disarm command. Shann discloses that an "abort" signal can be applied in the event that a fault occurs prior to transmitting a fire signal, and that the abort signal is transmitted to each of the circuits to cause the devices to effect a rapid discharge of the capacitors to prevent the detonators from detonating. The "abort signal" in Shann does not include the unique identifier of its logic device, as recited in claim 101. Accordingly, in Shann, the pyrotechnic devices cannot be uniquely identified to selectively disarm.

Claim 102

The Office Action rejects dependent claim 102 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, and further in view of Shann.

It is respectfully submitted that it would not be obvious to combine Abouv or Shann with Boucher, considering that Abouv and Shann provides no discussion of a missile. Physical limitations associated with electronics incorporated into a missile are quite distinct from those to be used in a console for a mining operation. One skilled in the art would not have looked to Abouv or Shann for solving the failings of Boucher.

Claim 104

The Office Action rejects dependent claim 104 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abouv, Shann and further in view of Tyler.

Claim 104 further recites that, after a disarming command has been acted upon in the pyrotechnic device, the pyrotechnic device responds to the bus controller by transmitting its disarmed status over the network.

As the Office Action acknowledges, neither Boucher, Abouv, Shann or the alleged Applicants's admission discloses transmitting a disarmed status. The Office Action cites Tyler for disclosing a computer in which status checks are performed. However, the claim recites that "after a disarming command has been acted upon, the pyrotechnic device responds to the bus controller by transmitting its disarmed status". The mere disclosure in Tyler of a computer that can transmit the status of a network is insufficient. There is no teaching in Tyler or any other applied reference, taken alone or in combination, about "responding" to the bus controller by transmitting the disarmed status for a device after the disarming command has been acted upon.

Claim 105

The Office Action rejects dependent claim 105 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abou, Shann and further in view of Tyler.

Claim 105 further recites that the bus controller periodically queries pyrotechnic devices at regular intervals to confirm that firing capability in the device remains intact.

The Office Action cites Tyler for disclosing a computer in which status checks are performed. However, the claim recites that "the bus controller periodically queries pyrotechnic devices at regular intervals." The mere disclosure in Tyler of a computer that can transmit the status of a network is insufficient. The Office Action provides no teaching in Tyler or any other applied reference, taken alone or in combination, about "periodic queries at regular intervals" or any querying about whether firing capability remains intact.

Claim 106

The Office Action rejects dependent claim 106 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Boucher and Abou, Shann and further in view of Tyler.

Claim 106 further recites that the bus controller determines network status by transmitting a network signal to one or more pyrotechnic devices and then sensing whether the signal is echoed back in response.

The Office Action cites Tyler for disclosing a computer in which status checks are performed. However, the claim recites that "the bus controller senses whether a network signal is echoed back." The mere disclosure in Tyler of a computer that can transmit the status of a network is insufficient. The Office Action provides no teaching in Tyler or any other applied reference, taken alone or in combination, about "echoing back" a network signal as an efficient mechanism for determining status.

5. Conclusions

Applicants submit that independent claims 91 and 101 are now in condition for allowance, and that dependent claims 92-100 and 102-106 are also patentable based upon the arguments presented and at least based upon their dependency from patentable independent claims. Accordingly, Applicants respectfully request that the rejections and objections be withdrawn, and that the case be allowed to issue.

If Applicants' representative can be of assistance in furthering the prosecution of this case, the Examiner is encouraged to contact the undersigned at any time, at (202) 434-1607.

Respectfully submitted,
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